

Notes
on the Modes of Operating in the M. & R. Office
Refinery, Melting Rooms, &c. —

P. 4. The chief difference in our practice is, that the Register is supposed to represent the M. & R. and makes entries of weights before & after melting, and ~~then~~ calculates the pr. ct. loss in melting each deposit. The M. & R. weekly discusses the losses in weekly groupings of deposits.

The M & R. has otherwise nothing to do with the Deposits, and, on sound principles, should not have, until they are officially delivered to him, when he becomes responsible for the Bullion; except that he advises how to melt the deposits, when called on to do so. Mr. H. Cochran, the Receiving Clerk can state what the practice is, with deposits, until they are passed into the M & R.'s hands.

The smaller deposits are ~~passed~~ ^{being small in number & weight} allowed to accumulate, usually, ^{until the close of the} ~~for a~~ month before they are transferred to the M & R. The large ~~deposits~~ are transferred to the M & R. as fast as received when he has ~~a~~ vault-room to receive them. It frequently

It frequently happens that with the present heavy ² silver receipts, for lack of vault room by the M. & R., the large silver bars are weighed ^{of} debited to the M. & R. ^{to be taken out when required to melt for coinage} but put back into the Suptdt's vault, the chief object ^{in this hasty weighing is to} ~~being to~~ ~~Receiving Deposits~~ close out an invoice of silver as soon as practicable, in order to make official returns of value to the party from whom any special lot may have been received.

Receiving Deposits When Deposits or Purchases, or Transfers are passed by the Suptdt. to the M. & R. they are usually passed in groups, the Receiving Clerk, ~~or his Assistant~~, the Register, and the M. & R. or Assist. M. & R. each ~~noting~~ ^{of each draft} noting the weight ^{the M. & R., or their delegates, and} separately, & ~~after that, one~~ ^{the Receiving} ~~clerk~~ ^{their several} of them calling out the weight, to which the others respond affirmatively or negatively, as they agree or otherwise. Every weight so taken is entered in ~~different~~ books by each of the three persons weighing, and after a series of weighings, the whole lists are compared by one reading ~~atoud~~ ^{the noted weights}. In the case of refined Silver bars, ~~now so~~ now so ^{properly} ~~extensively~~ ~~brought~~ supplied to this Mint, each bar of 800 oz. @ 1800 oz. is separately weighed, & the weight ^{entered}

entered into the books of the 3 weighers, as above. When they have to be left in the Suptdt's vault, as above stated, consecutive numbers are marked on each bar, by which they are entered in the M&R's book of weighings, as well as by the Nos stamped on the bars, & by the Deposit No^o of the Mint, thereby insuring identity.

The M&R. gives to ~~the Suptdt.~~ ~~the receiving Clerk~~ a Receipt for the Gross weight of bullion received, usually for each Invoice by itself; and for the smaller deposits of the Month at the beginning of the ~~Month~~ next Month, as soon as their value is ascertained by assay.

While the M&R. receives the Bullion in gross, he is debited with its Standard Weight, calculated from the Gross weight & the Assay, by two Suptdt's Clerks, separately, & by different methods. The M&R. has not official force sufficient to calculate ~~allow~~ the Standard weights of Deposits, as they are received, and must perforce accept the calculations of those ~~two~~ clerks as absolute truth.

Refining Gold

by Acid,

Our own Deposits of Gold are all refined, except those of merely melted coin, which are selected from the rest, to be melted alone. The other deposits *of varying* ~~frequent~~

varying from 5 oz. to 1000 oz. each in weight, are assorted in lots according to each range of 100 ~~oz~~ from 900 fineness down to 300, which last includes all deposits below 300. ~~to~~ This last lot ~~is~~ is worked alone, no silver being added to it, because it contains a sufficient quantity. To each of the other six lots, from 400 to 900, silver is added in such ~~proportion~~ ^{quantities}, that the proportion of silver (~~or other met including copper, &c~~) is to gold as about 2 to 1. Each of these lots is melted, & granulated by being cast into cold water. The granulations are boiled in pure nitric acid until nearly all the silver is extracted, & then further refined by hot sulphuric acid. The solutions of silver are entirely precipitated by common salt, and the resulting chloride of silver is reduced to metallic silver by granulated zinc. The reduced silver is washed, dried by a low red heat, & melted ^{bars} into silver ^{bars} of 998 @ 999 $\frac{1}{2}$ fineness.

The fine gold from which all the silver ~~has~~ been washed out, is dried at a low red heat, melted, & cast into bars of 995 @ 999 fineness.

Refining Silver

Refining Silver

5

Good silver of 900 fineness is directly melted into Ingots for Coin; Fine silver, ~~is~~ mixed with its due proportion of copper is similarly treated. All other silver, unless manifestly tough & adapted to coinage, is refined by acid. Such silver is cast into bars of about 200 oz. in the Deposit-melting Room, prior to their delivery to the M+R. These bars are boiled with pure nitric acid, the clear solution of silver racked off from the possible residue (^{separately worked for} often containing gold) precipitated by salt, ^{washed} the chloride of silver reduced by granulated metallic zinc. The reduced ~~silver~~ metallic silver is washed, dried, ~~is~~ melted & cast into bars of 998 @ 999 ~~is~~ fine, occasionally of 1000 fineness.

Making up Melts for ~~Gold~~ Ingots

In making up melts for Ingots, whether gold or silver, about one half the amount of fine metal ^{usually} is taken, ~~because~~ clippings ^{of} from previous workings received from the Coiner, make up the other half. ^{because} experience shows that ^{such} clippings tend to ~~soften~~ & improve the quality of newly-made alloys, & make it softer than ^{if the whole}

if the whole melt were made up of fine metal ~~and copper~~
~~the~~ with its due proportion of copper. Beside this advan-
tage, clippings of standard metal, ^{are charged into the metal} put into the freshly
melted metal, ~~from when it is nearly all melted~~, in order
to moderate the heat of the alloy, & reduce it to the tem-
perature best adapted to casting, as determined ~~by~~ ^{experience may}

~~The bullion to be made into Standard metal is weighed by~~
~~(who keeps an account of the weights)~~
~~the Assistant Melter & Refiner, put into a copper-lined~~
~~box. The M + R., or the Assistant M + R., weighs out the~~
~~due quantity of bullion to be made standard, notes the~~
~~weight (twice read, by himself & by the weigher) on the~~
~~in~~ ~~book kept for the purpose, called "the Working Book", and puts~~
~~the bullion into a copper-lined box.~~
~~He then carefully calculates accurately the amount of~~
~~alloying copper or of fine metal, as the case may be,~~
~~required to make the melt of standard fineness, and adds~~
~~it to the melt. A half dozen (more or less) such melts are~~
~~consecutively~~
~~so weighed out at a time.~~

* over
In this case also a double reading of the weight is ^{practised} ~~resorted to~~
to insure greater accuracy. The single calculation of the ~~stan~~
quantity of copper or of fine metal, required to make
standard, seems to be quite sufficient, for we have not found
an error in 1000 melts.

when a car

To facilitate the weighing out the precise amount of Copper,
the best copper Ingots ~~that present are employ those of Pope, Cole
& Co. of Baltimore~~ of 12 @ 15 lbs. weight are cast by us into
thinner ingots, some of which are again ~~cut~~^{sheared} into smaller
pieces, ~~and~~ ^{or they} are cast ~~into~~ ^{and} water to make fine granula-
tions of ~~that~~ some ingots are cast into cold water to ^{a special} is kept
make shot of various sizes & weights. ~~The account of~~
^{used for} copper alloy for gold & silver is kept apart from ~~that~~
~~used in the base coinage.~~

fine gold, next added. Experience has shown that the affinity of copper and gold for each other is a strong one, and ^{their alloy} ~~or but slowly~~ scarcely liable to segregate into richer & poorer alloys; ~~in a short space of time,~~ ^{as I think from my experience,} except through the presence of small quantities of ~~foreign~~ of some other metals ^{such as} antimony, & its sulphide, which ^{appear to} increase the tendency to segregation, and ^{except when} ~~when~~ melted without stirring.

To facilitate stirring the melted metals, I contrived a black lead paddle of convenient form, with a few holes ^{near} ~~thru~~ ~~at~~ the lower end, whereby the liquid metals ^{are} divided into many streams, ~~and~~ whose increased surface of contact ^{between} the gold & copper insures a more rapid & thorough ^{alloying} blending. Experience confirms the ~~excellence of these~~ efficiency of these stirrers.

Powdered charcoal is continually kept on the surface of the metal during melting & casting; The ingots coming hot from the moulds, are dipped for a few minutes in water acidulated with sulphuric acid & then washed & cooled in cold flowing water. After ~~having had~~ ^{cutting off the} their tops or pouring gates ~~cut off~~ ⁱⁿ (the being tapped) of ~~the~~ ingots, & filing ^{off} the feathered edges of ^{their} ~~the~~ sides, each ingot of a melt is stamped with ^{that} numbers representing the assay number of ~~the~~ melt from the beginning of the year.

Pieces are chipped from the first & last ingot of each melt, respectively marked 1 & 2 of that melt, (and the

and the result of their assay determines whether they may be delivered to the Ass't'dt. as of the proper fineness for coinage. ^{The minimum and maximum of fineness is rarely outside of} ~~as a general rule the fineness of our ingots~~ varies ^{betw.} ~~between~~ 899.9 ^{and} ~~and~~ 900.1, and our practice is never to allow a greater variation than from 899.7 to 900.3.

No 1
over

Making Silver Ingots

We usually ~~make up each~~ ^{cast from from each} melt. of Standard ~~to~~ Silver ~~to 3000 or 3200 oz.~~ about 3500 oz., which by tapping & filing each ingot is reduced to 3000 or 3300 oz. for the Dollar, ^{and rather less} ~~and or to 2700 oz.~~ for the quarter-dollar.

The melts are made in ~~N^o 70~~ ^{over No 7} Black Lead Pots, ~~in a similar~~ ^{part of} ~~manner to those of the gold melts,~~ the fine metal & all the copper ~~const.~~ being first charged & melted, before the rest of the fine metal, ^{last of all} & ~~clippings~~ being ~~last~~ added. A slight covering of borax, which facilitates the fusion, & protects in a measure against volatilization, ^{oxidation and} ~~is skinned off,~~ when the fusion is complete & the metal well ~~melted~~ & its total removal is more completely effected, stirred, ~~the borax is skinned off, a result facilitated by the~~ to which the remaining borax adheres, ~~which is wholly skinned off leaving a brilliant~~ addition of a little fine charcoal. ~~The clean surface~~ ^{so that both are more easily & completely} ~~of metallic silver. They immediately~~ ~~the melted metal is then covered with fine charcoal,~~ which is continually added during casting, ^{in the atmosphere of carbonic oxide, & acid} ~~and so that~~ volatilizing waste is measurably diminished, & the oxidation of both copper & silver prevented or diminished ^{altho'}

a loose black lead ring being put on the top of the crucible, so that the usual commercial pigs of silver, being longer than the interior height of a pot, & projecting above it, are protected from the ~~act~~ injurious direct action of the fire. This virtual deepening of the crucible further allows full & free stirring with less danger of spattering. A piece of ~~black~~ lead ~~is~~ is put at the bottom of the melting pot as a stool for the ~~large~~ ^{or} large rectangular pig to stand on while melting, lest its ~~sharp~~ weight (100 lbs. more or less) should press the solid angles through the sides of the ~~crucible~~ pot.

Alloying Silver with Copper for to attain Coin of 900 or

1. The quantity of Copper required to bring silver to standard fineness is different from that for gold. First, because, when a silver ingot is cast, ~~the~~ normal segregation throws a richer alloy to the center of the ingot, from which ~~part~~ the blanks are cut out, therefore the standard of ~~the~~ ^{the} ingot should be lower, so that the central part, ^{may be} the desired standard of 900 fineness. Second ^{because}, in spite of all precautions, while melting, there is a tendency ~~to~~ in ^{to} traces of copper to volatilize ^{or} ~~burn off~~ to that limited extent to ^{raise} alter the standard, so that a shade more copper should be used to replace that which burns off. Third, because, in the act of cleaning blanks, to give them a pure silver surface, they are plunged while hot into dilute sulphuric acid, whereby copper is extracted from the surface, & to a depth depending on the ^{strength of acid & time of immersion} time they ~~are~~ remain in the acid. I determined long ago from experience that in order to obtain ^{silver} coin of 900. we should not raise the metal above 898; but the more exact determinations ~~by~~ with Prof. R. E. Rogers proved that we should add so much copper as to bring the metal no higher than $898\frac{3}{4}$ fineness. We have followed this standard ever since with the result of fairly averaging 900 in our silver coin.

Altho

~~While~~ the stirring of standard silver is much more easy than that of gold, because it has ^{only about} ~~near~~ one half its specific gravity, ~~so that~~ ~~the~~ so that a thorough ~~on~~ blending of the metals into a homogeneous alloy is secured, yet the strong tendency of the standard silver, ^{alloy} to segregate into richer & poorer alloys, both in the melting pot, & in the act of congealing, demands special and watchful care, when casting standard silver ingots.

Segregation & True Assay of Silver

Altho the general fact of segregation was known long since, & the law of distribution of poorer & richer ^{silver-copper} alloys ~~of~~ had been determined by the Assay Dept of this Mint, yet its importance & influence has been increasingly acknowledged up to this very year. ~~Some~~ ^{not many} years since it was ^{stet} ~~proposed~~ that the method in use up to that time of clipping off a slip from the first & last ingot of a melt for assay did not ~~yield reliable results~~ ^{give the true} ~~in assay of the~~ average fineness of the ~~selected~~ metal. The method was then adopted, which has ^{ever} ~~since~~ continued in use, of casting some of the metal into water ~~at the~~ ^{(granulating) upon} beginning ^{to} ~~of casting~~ a melt, & just after thorough stirring, and ^{granulating} again just before finishing the casting of a melt. The uniformity in the assay ^{returns} of these two granulations ^{may be} presumed to determine ^{all the intermediate} the true fineness of the metal. Even when this method is practiced, the importance of thorough stirring was

word Segregat

out?

was clearly shown at the annual Assay in Feb. 1877, when the first & last granulations of melted com, that had been stirred, but not enough, showed wide variations in ~~the assay~~ fineness, upon assay, ^{but after} until by remelting & thorough stirring, ^{nearly} they coincided.

~~Stirring Casting Silver Ing~~ ^{Silver} ~~Stirring~~ ^{Ing}ot melts. The above illustrates the ~~int~~ vast importance of stirring Ingot melts immediately before casting. It is the more important ~~bec~~ at the present time, because most of the fine silver received from Refineries retains ^a small percentage (one or more thousandths) of base metal, lead, antimony, &c., which, in my view, tends still more strongly to induce the segregation of alloyed silver & copper into richer & poorer alloys, thereby ^{up} destroying ~~breaking~~ the legal standard. While casting a melt of standard silver, the stirring ^{should} be continued, either ~~by~~ directly ~~by~~ by a stirrer, or by an occasional dipping cup full of metal raised to a little height above the melting pot & poured into the latter, or lastly by thrusting the dipping cup into the melted metal up & down, so as to mix the metal. The melted metal should be disturbed continually during ~~melting~~ casting to insure ~~the~~ the maintenance of the legal standard from the beginning to the end of the casting. Even

Even with the precaution of keeping the melted silver agitated to counteract segregation, we always leave a portion of silver (200@300 oz.) in the melting pot for the next melt, because ~~and~~ it would take too long a time to dip out the last remnants, which ~~would~~ might induce segregation, & which would certainly expose the silver to volatilization, because the relative mass of the fire is so much greater than the small metallic residue, as to bring the latter to a volatilizing heat

~~When all the ingots of a melt have been cast~~

When cast, the silver ingots are treated similarly to the gold, dipped in dilute acid, topped, filee filed on their edges & dried, with ~~only~~ this difference that only ^{silver} ingots of the ^{silver} top layer ~~of ingots~~ in a box ^{or melt} are stamped with the number of the melt. over

Delivery of Ingots & Receipt of Clippings

The Suptdt. ^{he} acts ~~as the~~ ^{intermediately in transferring} ~~as the~~ ^{intermediately in transferring} ~~metatransfer medium~~ of Ingots from the Melter & Refiner to the Counter, & of Clippings from the latter to the former, all three officers or their delegates being present at and during each transfer. The Suptdt's ~~each~~ ^{one} delegate weighs the bullion; each of the three deputies reads & puts down the weight; after which the weight is read ~~out~~ aloud. discrepancy

Since an ingot of $898\frac{3}{4}$ m will make coin of 900, it is ~~over~~ the
usual practice ~~not~~ of the Assayer, not to certify to the equality of ingots
outside of 898 or 900; but it is ~~fixed~~ ~~at~~ ~~the~~ ~~standard~~
of nearly all fluctuates between $898\frac{1}{2}$ and $899\frac{1}{4}$ m.

Disagreement in weights is rectified by reweighing.

Gold melts of Ingots are weighed singly; but silver melts of about 5000 oz. each in masses. The ~~not~~ entries in their respective books consist of the date of entry, the number of the melt (if gold), the number of the draft in weighing, the description of bullion (such as clippings, or number & denomination of ingots), and the ~~the~~ weight. At the close of the transfer, the sum of ingots ^{of ounces} & ~~of Ingots~~ is noted by each delegate, & read aloud to clinch the accuracy of the whole transfer.

Summaries of deliveries are compared monthly or oftener.

Full receipts are given at the ~~time of~~ close of each delivery or Fine Bars by the Suptdt. to the M & R. for Ingots, & by the M & R. to the Suptdt. for Clippings, ~~or other Bullion~~ (rarely other Bullion).

At the close of each day's work, the filings of the day ~~are~~ gathered. ~~weighed, as filings the tops are weighed. These, and the tops of~~ Clippings, or other bullion, not cast into ingots, are the ingots, ~~and~~ the residue of the last melt cast into bar form, are all ~~the~~ separately weighed.

~~as against the~~ Daily record of Melting ~~the~~ Gold & Silver by the M & R. Mastermelter ~~to the melting room each morning~~
 Records are kept of the amount of bullion sent out such as the above residues ~~at the close of each day~~ ^{of} the previous day's work, clippings ~~sent~~ received from the Suptdt, melts made up of fine metal ~~and~~ with their suitable alloy, ^{and} other bullion, all calculated ~~to the~~ and made up

by copper or fine metal)

Master Melter

made up to the standard of $898\frac{3}{4}$ m. The ~~Melting~~^{the Master Melter} is charged with all the above. At the close of the day ~~he~~^{and afterwards} is credited with the then ~~residues~~^{any}, as above noted, with the weight of the Ingots (when delivered to the Assayer), with the weight of condemned melts, & with the grain of that day. The sweepings of the floor

gather

At the close of each day's work, the sweepings of the melting

skin muck

put into an old melting pot

room floor, & the fluxed slags of each melt, are ~~kinged~~^{left} in a

~~left~~ good fire to bring out the ~~left~~ left to King in a good fire. The ~~stamped~~ with the date is melted with into a bar. The King is the next ~~King~~ put into the vault, until the grains in its flux are sifted out, when morning melted with the grains. ~~grains~~ are sifted out of its flux, into a bar. The bars are melted in to a bar called grain-bar of such a date, stamped called grain or grains bar.

with its consecutive N° from the beginning of the year, & credited to the

the previous

Master Melter for ~~that~~ day's work. To make the Daily Melting

Record ~~complete~~^{more complete} & truthful & reliable

all the deliveries to, & returns from, the Master

standard of 900 m.

Melter, as above, are calculated to the ~~proper~~ standard, the

the Ingots, bars & tops, filings, & prepared

made up melts, being assumed

at 899 , & the clippings at $898\frac{1}{2}$ m, all other lots ~~at~~ the fineness

being calculated from the balance between these

reported by the assayer. The debit & credit accounts

show approximately the losses of that day's work, with sufficient

They are used at the usual

approximation to the truth, to ascertain whether serious losses

rate, or are excessive.

have occurred. ~~General~~ General grains are

desirous of knowing this as soon as possible after the melting, the ~~excluded from this account~~, the daily bar of general grains & the sweep are excluded from the account.

At the close

(filing beneath)

of the stone-floor under the iron grated floor, near the ~~mettles~~ furnaces &
~~the floor under the iron latticed.~~

At the close of day's work, the sweepings ~~of the melting room floor~~, and the slags skimmed from all the melts of the day, are put into an old melting pot, & left to ~~king~~ in a good fire. On the following morning the ~~flux~~ ^{mettling} furnace & the worn out pots ~~are~~ ^{are} ~~the~~ ^{the} slag on the king, & the ashes of the previous day, are ground & sifted in the sweep cellar, making coarse grains, & fine matter finer powder. This powder, when washed, yields fine grains & sweep. The king with is melted with the coarse & fine grains into a bar, termed ^{the} grain-bar, or ~~shorter~~, "grains", which is stamped with its consecutive number from the beginning of the year, and credited to the master melter for the previous days work. The slag from the grains ~~helps~~ to form a ^{bar of} ~~General~~ ^{grains} bar for the month.

~~The former of which is~~
~~The fine grains are gathered from the top of the washing machine~~
on the second morning after melting & dried.

At the close of ~~the~~ a month all the ^{daily} grain-bars of the month are melted into ^{or more} one bar, called "Consolidated Grains", whose weight & assay confirm the standard weight of the sum of standard weights ^{crucibles} ~~the old melting pots~~ ^{daily} are ground of the separate bars. The slags from melting the grain-bars, & sifted, ^{the mouth} ~~of silver~~ the residues from cleaning the dipping ingots in acidulated water dilute sulphuric acid, and any other possible residues, are gathered ~~ground~~ if ~~ever~~ melted at the close of the month into one or more bars, termed General Grains. These always ~~exist~~ diminish materially ~~sweep~~ the apparent daily losses, which are further reduced by the sweep & amalgam.

Sweep.

{ From melting
for gold & silver }

The residues, above noted as passing through sieves ^{finally} in a dry state suspended in a constant stream of water, (up to N° 60) are passed through a washer & amalgamator. The fine matter of the water, after depositing its fine grains (part of the grains from the washer are taken ~~with~~ the general grains. of the daily grains, as above) of the daily or general grains, the finer matter is forced through mercury which takes up a ~~large~~ proportion of gold & silver. The amalgam is ^{usually} occasionally distilled, & the bullion once in a month, & its melted bar ^{assayed, numbered &} numbered, named "Amalgam-bar". The sweep which passes from the mercury is sweep, suspended ^{being moderate in quantity} The amalgam is distilled once a month or occasionally, & yields a bar, termed amalgam which when melted, is assayed, ^{termed} numbered, ~~as~~ Amalgam-bar. in water

in water, and flows into a settling tank, consisting of which is a wooden box, lined with sheet lead, & divided into 3 compartments by partitions of sheet lead. The stream entering one compartment, into the next one flows, through an open slit in the middle of the ~~partition~~ diaphragm, through a similar slit into the ~~the 3rd~~ ^{upper} third, and lastly over the top of the box, which at that point is a little lower, into another settling tank below the ~~top~~ one, ^{from which it is drawn off clear from sediment:} then lastly into deep wells ^{the gr. By far} larger & most valuable. The greater part of the sweep settles in the 1st compartment of the upper vat, from which a barrel of sweep is often collected daily, while the lower vat & wells are not cleaned oftener than once in the year.

There are two such upper vats, so arranged, that while one is ~~being~~ emptying, the other is filling. The sweep

The dried sweep is arranged in lots of ten barrels.

The dried sweep is first sufficient for a barrel is first mingled by shovel on a stone floor, then again mixed by shovelling more thoroughly mixed by blences by into a large box, then sifting from this ~~box~~ into another similar box, & lastly once more mixed by transferring it to a barrel. The sweep, thus ground, sifting, & washing, to ^{dust} grains of uniform size, ^{reduced, by} ^{reduced to} ^{dried to a powder} ^{handling, & c.} becomes, by this repeated ~~mixing~~ as perfectly commingled, as it is possible to make a mechanical mixture; but in order to obtain, ^{of sweep is pierced through its whole depth} a perfect if possible, a still more perfect average for assay, each barrel ~~is supplied~~ by a hollow steel cylinder

cylinder, (like those used for flour barrels), ~~made for the purpose~~, of the full length of a barrel, ~~the~~ which is drawn out full of sweep, representing every inch in depth. Our practice is to

each barrel having been prepared & drawn sample ten barrels of sweep for assay in the manner just described, ~~each~~ ^{averaged by} The ten samples are repeatedly mingling ~~and~~ ^{and} sifting; and the averaged assayed for gold & silver.

There I cannot imagine a more perfect system of averaging sweep than this, which I introduced many years since. The assays of sweep are made as soon as each lot of ten barrels is filled. The barrels are headed up and weighed, as soon as sampled.

Special Accounts.

Daily Meetings

^{This account}

~~D. The account of daily meetings~~ has been already described.

in detail.

~~Deposits~~

Over

~~This month~~

~~Refining~~ ^{On account of the small amount of our own deposits} ~~for Refining~~, our practice is to take the gold once or twice in the month. The gold deposits are arranged in 7 ~~box~~ series, (one or more boxes to each series) according to their hundredths of assay fineness, from .300 to .900, those below ~~.400~~ ^{.400} in ~~one~~ one lot, called the .300 series, ~~the~~ (or 3rd box), those ~~below~~ from .400 to .499 in the 4th box; &c. ~~the~~ ^{the} ~~those~~ deposits derived from ^{good} coin being reserved for melting only. So much gold of each box is taken as will make 2400 oz., or a melt for granulation, when calculated. The quantity of silver is added to it, to make the ratio

Refining Account

~~Refining~~ The large Gold & Silver deposits are taken by the M. & R. in quantities by themselves, ~~the~~ the smaller every day as soon as practical after ~~their assay~~ the calculation of ~~or two~~ and all ~~as soon as~~ after they are assayed & their value from weight ~~assay~~ A receipt is on each occasion given for the gross weight received ascertained. They are separated into those of standard fineness from melting coin, those to be simply melted again into standard Ingots for coin; — 2 into fine bars, to receive their due proportion of copper alloy & to be made directly into coin-ingots; — 3 and into those requiring to be refined by acids. If either hard or brittle, they are toughened by fluxing in the Melting Pot. If any lots of Nos 1 or 2 be

The two former classes are embraced in the Account of Daily Workings; the last are ~~embrace~~ in the Refining Account.

The quantity of Gold & Silver (or base metal) in the ~~gold deposits are~~ calculated, & so much silver (whether base or fine, is not essential) added, that the ratio between pure gold & silver (including ~~the~~ base metal), shall be about 1 : 2 ^{about} usual. The melt of 2400 oz. therefore consists of 1800 oz. of pure gold, & 1600 oz. of silver, &c. After melting & thorough stirring, the alloy is dipped out, & cast at from the height of several feet by a gyratory motion into very cold water, the object of such granulation being to present as large a surface as possible to the subsequent action of ~~pure~~ nitric acid, of 35° @ 40° Beaufree. The granulations are ~~put into~~ ^{steamed in} 20 gal. porcelain pots, in pure nitric acid of 35° @ 40° Beaufree ~~boiled over them~~, the unsaturated acid being ^{from} ~~economically~~ added as part of the charge. The undissolved residue of tolerably fine gold, (The solution of nitrate of silver is drawn off) which is washed with water, and the silver recovered from the nitrate solution by common salt

~~over~~ between gold & silver, 1: 2 (approximately). Of course the silver deposits containing gold are employed instead of silver alone, as far as practicable.

A debit account against the Refinery. An exact account is kept of all the gold and silver sent into it each ~~for~~ lot or bar, however small, being entered separately used for Refining, reduced to standard weight. After in gross weight, fineness, & standard weight.

The refining is completed, all the refined on The Refinery is credited with all gold & silver, refined & melted, which it returns to the Vault, in the form of bars, grains, &c.; and a balance is struck between the two sides. As a general rule the loss is very small; where it is larger, it is minutely investigated ~~to determine~~ until the cause of the apparent or real loss is ascertained.

Vault Account

the vault is debited with A special account is kept, in which all the bullion put into the vault is ~~charged~~ debited, and credited with all taken out, the gold & silver being kept ⁱⁿ separate accounts.

The different objects of the account are classed together according to their nature, such as fine silver bullion, clippings, grain bars, deposits, &c. each of which constitutes an account by itself, & additions are made ^{to it}, or figures cancelled, as the case may be. Where constant frequent changes are going on, we cannot at any moment ^{the accounts}

~~by common salt solution~~ as chloride, which is reduced to metallic silver by granulated zinc, thorough washing, pressing dry, & melting.

The gold residue is treated by hot sulphuric acid in iron pans ~~at~~ by two successive charges, so that when the acid is poured off, the gold ^{pressed} washed & melted, it exhibits a fineness of 99 $\frac{8}{10}$ or 99 $\frac{9}{10}$

Pressing and Drying reduced gold & silver is reported to save loss by ~~mechanical dusting in the fire~~, for if the ~~few~~ refined & powdered metal be put into the melting pot without pressing & drying, it boils in it, often violently, from the escape of steam, & the fine particles are carried ^{with the vapor} ~~escaping~~ out of the top. The reduced metal, after ^{washing by common paper} ~~sample drainage~~, is pressed into cheeses, which in silver weigh about 140 lbs. ^{each} by a powerful hydraulic press; and these solid cakes are dried on iron pans at a low red heat. When the broken cakes are now melted in the pot, not the slightest ebullition is perceptible, & the refining accounts show that ~~there is no appreciable~~ loss, is quite inconsiderable.

Instead of granulating we sometimes melt the gold with ~~in the ratio of 1:~~ silver in the ratio of ~~1:1.5~~ $1:2\frac{1}{3}$, cast them into 12 or 15 lb. bars, ~~which~~ and treat them in like manner with oil of vitriol nitric acid & oil of vitriol.

The accounts are always left open, because of the frequent daily changes in the contents of the vault, but ~~it~~ ^{but} it would require only a few minutes' time to ~~tell the~~ ^{To} determine the whole amount in the vault. For the same reason, of constant changes, the account is only kept in gross, ~~not~~ calculated to standard weights, but as the finenesses are either entered in the account, or easily obtainable from other ~~accounts~~ sources, ~~a~~ ^{short} the whole could be reduced to standard weights in a short time. ~~The manner~~ Each bar, ~~is~~ melt, or lot, ~~is~~ ^{entered on the} ~~entered by~~ set down ~~put down~~ in the vault book is set down ~~the~~ date of entry, ~~the~~ number of bar, &c., ~~the~~ description, gross weight, fineness in gold and silver, and date of removal.